Gas-Filled Cooling Section

Study 2B

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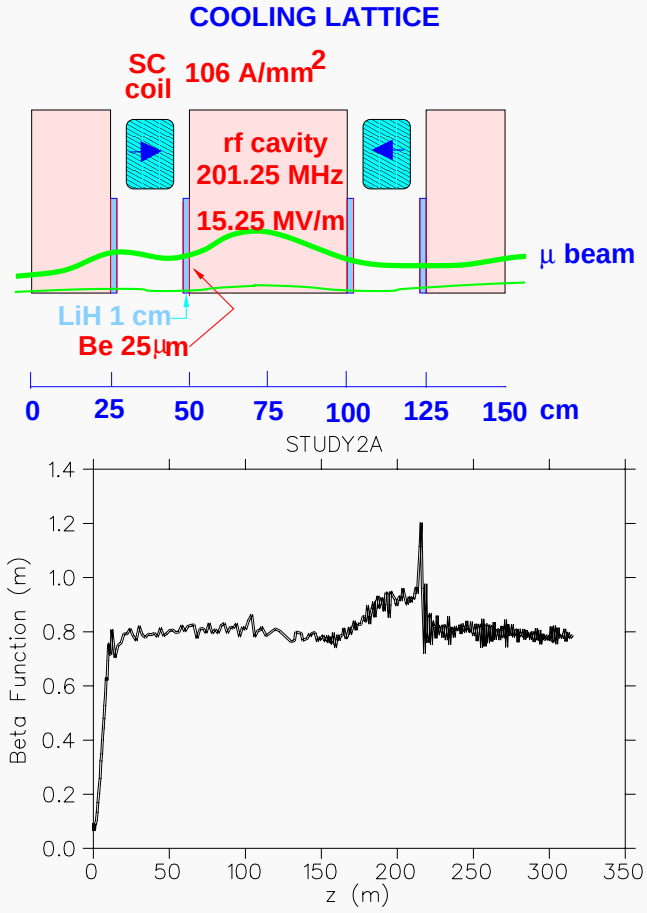
Introduction

The cell in the cooling channel has an almost constant *beta function*; this suggest that the *discrete* LiH absorbers may be replaced by an *uniformly distributed* high pressure hydrogen gas (GH).



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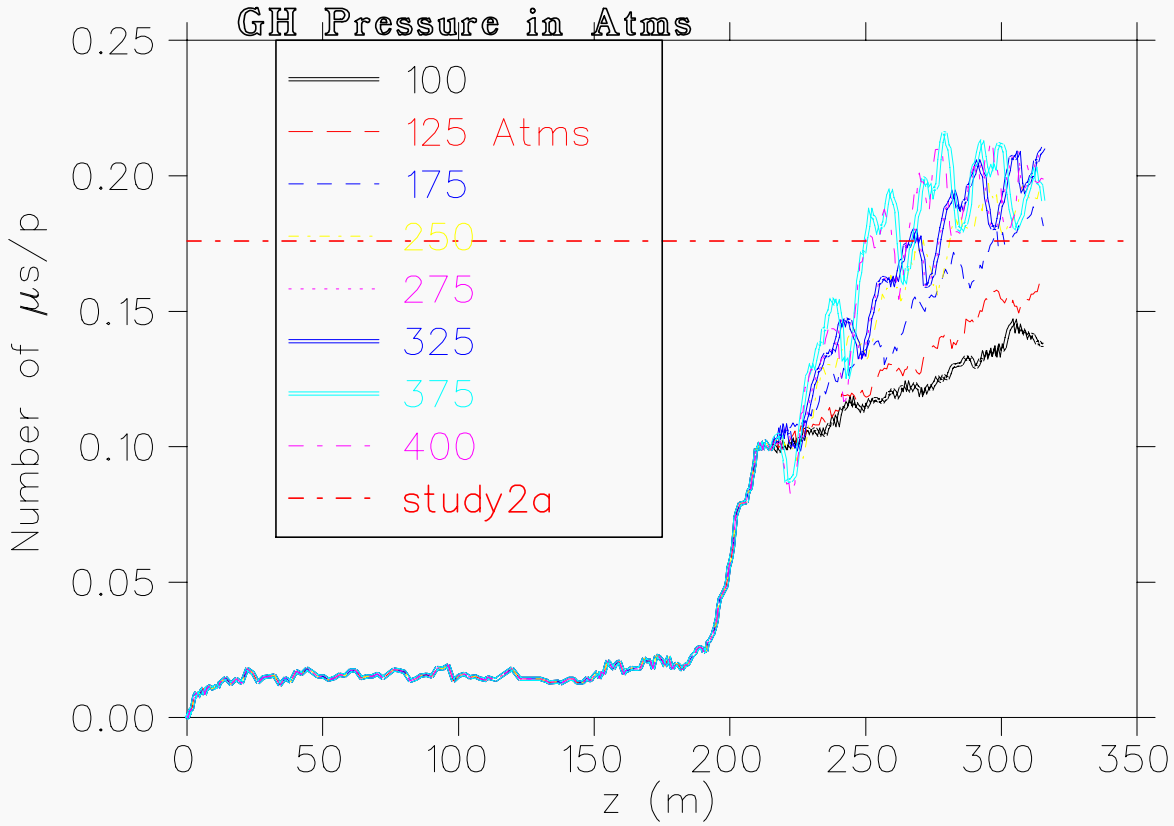
Calculations

The cooling channel consists of 66 cells with 4 LiH windows of $1\,cm$ thickness each. The minimum of the energy loss for both GH and LiH are:

$$\frac{dE}{dx}|_{GH} = 4.103\,\frac{MeV}{g}cm^2 \qquad \frac{dE}{dx}|_{LiH} = 2.038\,\frac{MeV}{g}cm^2$$

The total energy lost of the muon beam in the LiH window is
$\Delta E|_{LiH} = 2.038 \times \rho_{LiH} \times 66 \times 4 \approx 420\,\text{MeV}$
At $25°$C and 1 atm, GH gives
$\Delta E|_{GH} = 4.103 \times \rho_{GH} \times 66 \times 150 \approx 3.4\,\text{MeV}$ where $\rho_{LiH} = 0.78\,\frac{g}{cm^3}$ and $\rho_{GH} = 8.38 \times 10^{-5}\,\frac{g}{cm^3}$. This implies we have to increase the density (pressure) of the GH by a factor of 124.

ICOOL simulation



Number of μs per p on target into the accelerator normalized trans. acceptance $A_T = 30$ mm rad and normalized long. acceptance of $A_L = 150$ mm for a momentum cut $0.1 \leq p \leq 0.3$ MeV/c for several HG pressures. The horizontal red line is the final performance achieved in Study2B.

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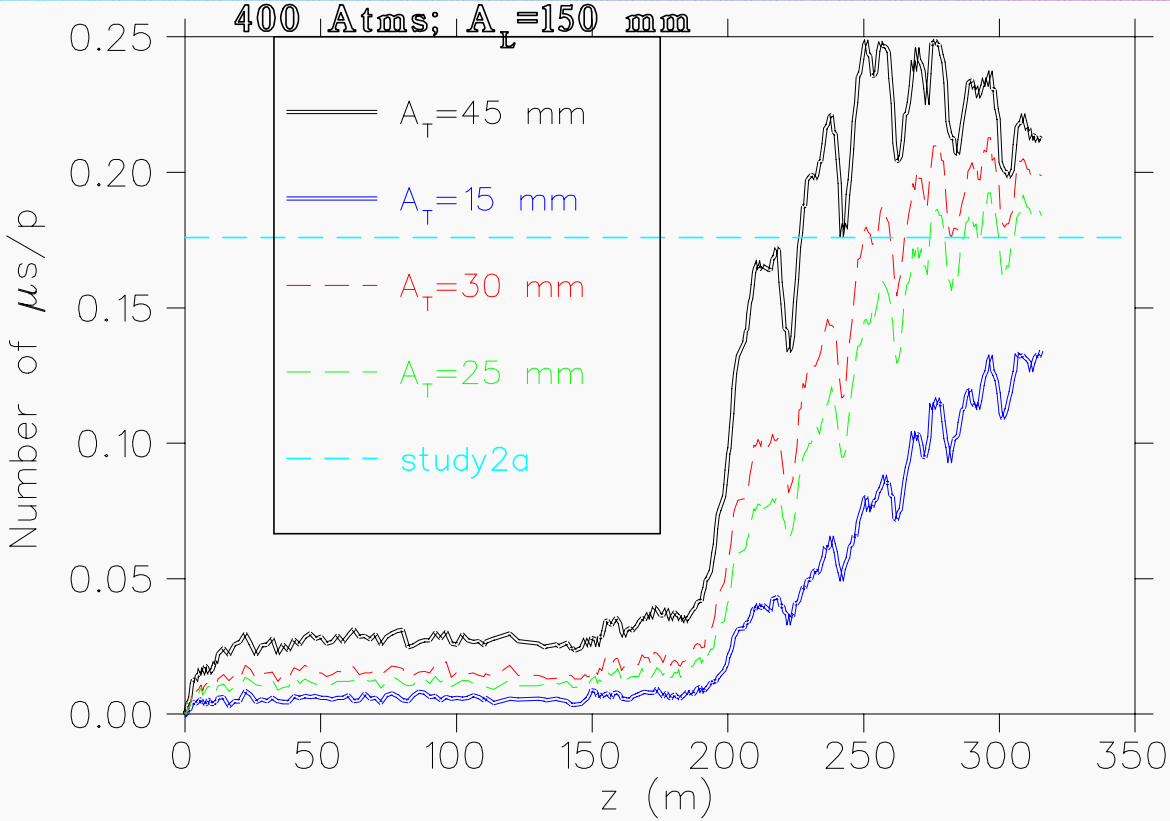
ICOOL simulation



Same as above for different $A_T s$.

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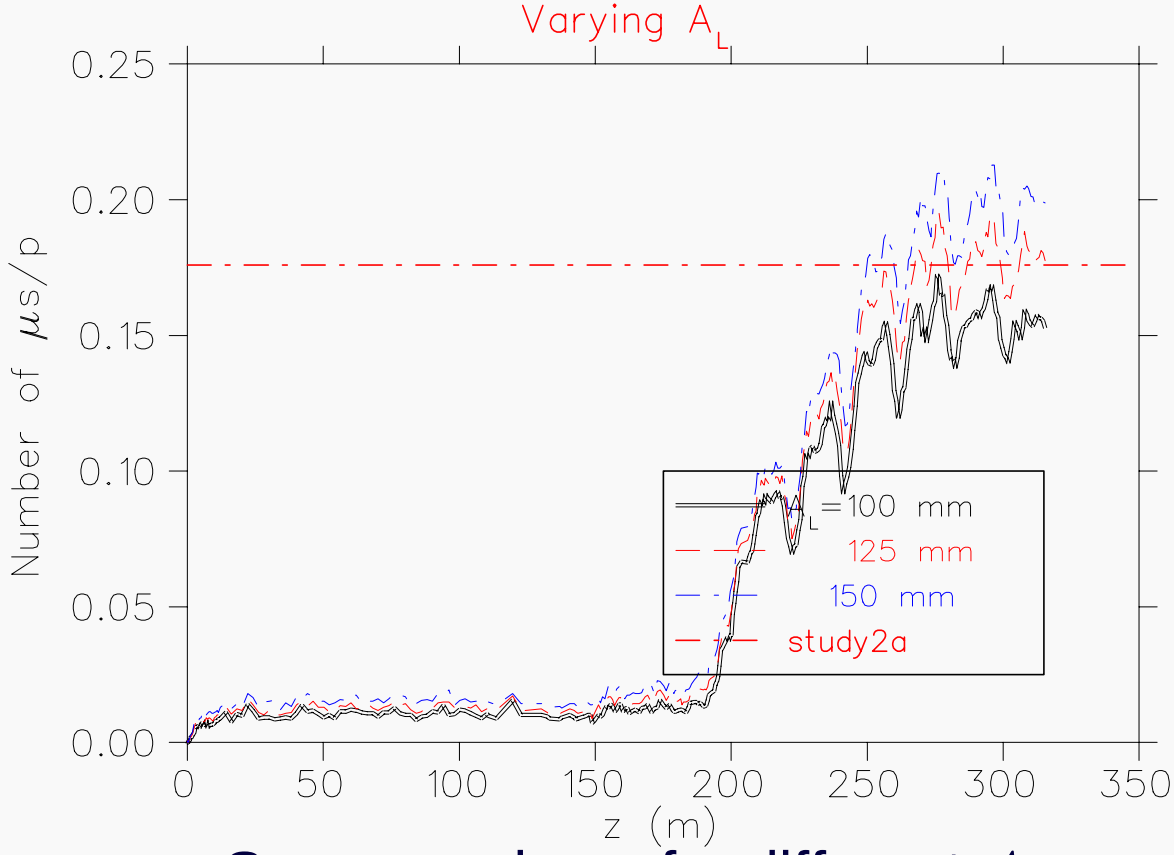
ICOOL simulation



Same as above for different $A_L s$.

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Conclusions

The results indicate that we achieve a better performance by $20\ \%$ than Study2B (No. $\mu/p = 0.21$) with high pressure gas (GH) 375 atms at $300\ ^\circ K$ or 96 atms at $77\ ^\circ K$.